

MOBILE HEALTH APPLICATION FOR DIABETES SELF-MANAGEMENT

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ABSTRACT

As mobile healthcare applications are becoming more and more popular, it brings patients a more convenient way to self-management and communicating remotely compare to the traditional healthcare system. This paper introduces a healthcare mobile application of diabetes self-management that designed, developed, and tested by professor Li's research team. The application is going to be used by American Indian diabetes patients in Lower Sioux Tribe. The application enabled patients to self-monitor their nutrients intake and health information. The social chatting and education functionality allow users to communicate and get educated remotely. By combining the advantages of both mobile health application and self-management systems together, the application provides great benefits especially for chronic diseases like diabetes. It is thrilling to see more and more implementations of mobile health self-management applications and improve the treatment of chronic disease.

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CHAPTER 1. INTRODUCTION

1.1. Introduction of Diabetes

Diabetes has gradually become a common disease and health problem all over the world. In most of the developed countries, it becomes the fourth leading disease causes death (Meuleneire, 2015). Diabetes could result in lots of complications such as a coronary artery, stroke, amputations, renal failure and blindness and so on (Meuleneire, 2015). It dramatically influences life expectancy, increasing disability and health costs for society (Meuleneire, 2015).

Meanwhile, there is substantial evidence that shows diabetes is going to be epidemic in the next few decades and the number of people who suffer diabetes is going to increase dramatically (Meuleneire, 2015). WHO estimated the global burden of diabetes is going to be doubled from 135 million in 1995 to 299 million by 2025 (King H, Aubert, 1998 WHO 30). Meanwhile, a similar result has been estimated that 333 million people will suffer diabetes which accounts for 6.3% in the adult population, by 2025 (Meuleneire, 2015). There are a couple of factors that cause the number of diabetes patients to keep increasing. The main factors are aging populations, increasing urbanization, dietary changes, reduced physical activity and other unhealthy lifestyles (Meuleneire, 2015). On one hand, the economic prosperity gives people a better opportunity to fill their desire, on the other hand, people need to control their desire and think about a healthier lifestyle to prevent the disease like heart disease, stroke, obesity, and type II diabetes.

The diabetes circumstances are even more serious for minority groups like American Indians and Alaska Natives. Based on the information from the National Diabetes Statistics Report in 2017, American Indians and Alaska Natives hold the highest prevalence of diagnosed diabetes for a total percentage of its population (15.1), men percentage (14.9%) and women

percentage (15.3%) (Centers for Disease Control and Prevention, 2017). With such a high percentage of diabetes diagnoses rate in this minority group of people, Zhao and other scholars researched the factors from metabolic markers perspectives which could provide valuable information on diabetes development and also potential novel treatment options (Zhao et al., 2015). Besides that, Diabetes is no longer a disease only for aging people among American Indians, the data indicated diabetes prevalence is increasing in American Indian Children. Among 5274 Pima Indian children aged from 5 to 19, for age groups 5–9, 10–14 and 15–19 years each group diabetes diagnosed children have increased around 1 to 2 percent in 20 years (Dabelea et al., 1998).

Diabetes is becoming a more and more serious health problem in the 21st Century. It is so hard to deal with is because people changed dietary, reduced physical activity and modern lifestyle. Moreover, Diabetes is gradually towards the younger generation. The prevalence of diabetes among childhood is estimated to increase about 1-3 percent annually in many countries in the world which made it becomes an even more challenging health problem in the future (Meuleneire, 2015).

1.2. Self-Management System

Every day, people are facing decisions. Self-management is an important way to guide people's behavior and lead people to reach the desired goal and make the right decision (Bodenheimer & Lorig, 2002). As for patients who have a chronic disease, their daily decision and habit are extremely important for their health condition. One research studied two brothers who have the same chronic problems inherent from their parents. However, one of the brothers regularly exercise, concerned his diet and monitor blood pressure and glucose regularly to prevent early death (Bodenheimer & Lorig, 2002). Whereas, the other one did not manage the

chronic problem very well. It turns out he gained weight, developed diabetes and have a hard time controlling his glucose level and blood pressure (Bodenheimer & Lorig, 2002).

Patients decide their own diet, exercise, and others factor which may influence their health. Therefore, self-management is an inescapable fact that chronic disease patients have to face (Bodenheimer & Lorig, 2002). When new technologies like smartphones and the internet become prevalent, it brings patients a new idea of self-management.

1.3. Mobile Health Application and Self-Management System

Nowadays, people are more likely to use mobile phones rather than traditional wired telephones. Based on the survey from the National Health Interview Survey (NHIS) in 2017, 52.5% of Americans homes only have wireless telephones (Blumberg, Ph, & Luke, 2017). Around three-quarters of people who are aged between 25-34 living in households without wired telephones (Blumberg et al., 2017). Moreover, 70.7% of all adults who are renting houses living in wireless-only situations (Blumberg et al., 2017). As the mobile phone is becoming more and more popular, the smartphone takes this trend which provides better computing capabilities, larger screens, and with open source development environment that extremely accelerates mobile application development compare to the original mobile phone (Jones, Boulos, Wheeler, Tavares, & Jones, 2011). More and more mobile applications have been developed so as healthcare apps. Over 40,000 healthcare mobile apps had been developed and available in the U.S Apple iTunes store in 2015 (Silva et al., 2015). A similar result had also been mentioned in the study about healthcare mobile technology usage in France, the USA and the UK in 2016. The studies indicate that there are over 100,000 healthcare mobile apps could be chosen from users by using different platforms(Currie, 2016). Moreover, both the users and downloads nearly doubled every year (Currie, 2016). This number is likely to keep increasing in the future.

Because the senior people in the future are the young generation and middle-aged people today who are more likely to use smartphones, internet, and trendy technology to take care of their health in their daily life (Jones et al., 2011). The same point is also addressed that successful healthcare mobile apps are targeting the younger generation as their users (Jones et al., 2011). It is believed that in the future there are going to be more and more healthcare mobile apps coming out involved with more and more users who are the young generation today.

New technologies have been changing people's lives in every aspect especially in younger generation. Recently, as new technologies like smartphone apps and internet applications come out, it makes diabetes self-management easier to use and implement (Hunt, 2015). People are using their smartphones more and more frequently and the capability of the smartphone provides a great way to develop and improve diabetes self-management system. More and more people are using mobile apps for self-manage chronic diseases, and from 2009 to 2011 the number of applications for self-management of diabetes in the iTunes store has increased 400% (Chomutare, Fernandez-Luque, Arsand, & Hartvigsen, 2011). On the other hand, implement self-management into mobile applications can bring lots of advantages. Patients may face many constraints when they try to manage their chronic diseases. Problems such as scheduling or location constraints to meet with providers, financial difficulty and other constraints can prevent patients to manage their chronic disease (Song et al., 2009). Technologies like mobile apps can overcome these constraints and support self-management functionality and guide patients to monitor glucose and blood pressure regularly, exercising, eating habit and so on with low cost (Hunt, 2015). Meanwhile, mobile apps can provide the function which visualizes the feedback of patients' clinical information and, this is beneficial for patients to realize how their self-managed behavior effect diabetes, therefore, improve their decision-making and

problem solving (Bond, 2006). A good self-management result can also motivate patients and lead to more often contact with providers (Bond, 2006). It is thrilling that new technologies like smartphone apps and internet-based applications bring chronic disease self-management a new strategy. Moreover, it is leading the self-management system to a whole new level (Bond, 2006).

As mobile health apps with the implementation of the self-management system are getting more and more popular. It is promising that shortly this new trend of the self-management system could play a more important role for people who have chronic diseases.

CHAPTER 2. RELATED WORK

2.1. Related Work

It is very common and complex for diabetes patients to control their blood sugar at a healthy level. High blood sugar level also causes other complications like cardiovascular, renal, neural diseases (Kirwan, Vandelanotte, Fenning, & Duncan, 2013). According to researchers Kirwan et al., (2013), they conducted research that studied the effect of a diabetes self-management smartphone application on type 1 diabetes patients. Participants were recruited through registered patients from Diabetes Australia in New South Wales and Queensland. Qualified participants must be aged between 18 to 65, diagnosed with type 1 diabetes more than 6 months, glycosylated hemoglobin levels (HbA1c) greater than 7.5% and own a smartphone. The participants were divided into two groups. One is the intervention group which is using diabetes self-management iPhone application and the assistance from Certified Diabetes Educator (CDE) based on the information collected by the app. The other one is the control group which remains unchanged of the usual care they had. The diabetes self-management application they were using is called Glucose Buddy which provides useful functions such as manually enter blood glucose levels, insulin dosages, diet, and view their customizable health information graph. The CDE needs to review the relevant data collected through the app for a weekly basis and send personalized messages to the intervention group. The message covers topics like problems regarding the health information data, educational tips, and questions regarding diabetes and positive encouragement. After 9 months study, the result showed that the intervention group who was using Glucose Buddy application and weekly advice from CDE had a dramatic decrease in HbA1c (from 9.08 percent to 7.80 percent) compare to the control group (Kirwan et al., 2013). The result is thrilling, and it is also agreed with Kirwan et al., (2013) that

the smartphone application with real-time message assistance from providers may have a great chance to take diabetes self-management to a whole new level.

In China, 110 million people are suffering from the inconvenience of diabetes and 80.8% of people are over 60 years old (Gao, Zhou, Liu, Wang, & Bowers, 2017). This fact incents Gao, Zhou, Liu, Wang, & Bowers, (2017) to conduct research focused on if diabetes self-management mobile applications from Chinese mobile app market fit for older people. The mobile apps are chosen from the top 500 rated medical apps from Apple App store and 360 Mobile Assistant. Finally, 71 diabetes self-management mobile apps were picked for evaluation. The evaluation is based on the global guideline and recommendation of older people with type 2 diabetes which is created by the International Diabetes Federation (IDF). Nearly 100% of apps implement a Blood glucose recording feature (70/71). More than half of the apps include features like medication tracking (44/71), diet management and recommendation (36/71) and basic healthcare knowledge education (40/71). Some of the apps include professional consultation (32/71), automation self- assessment (15/71) and social communication support features (13/71). Although most of the criteria from the guideline are covered, some of the common issues to older patients like pain assessment and fall prevention are completely missing in apps. Meanwhile, some of the features which most apps don't include are actually very important to older patients. Features like periodic assessment, providers' advice and emotional support, and input fault tolerance are helpful for diabetes to not keep developing. As a result, it is recommended to let medical professionals, researchers, and app developers to work together (Gao et al., 2017). Although the Chinese self-management diabetes apps with multiple features are good in usability, the features regarding common issues to older diabetes patients are absent in apps (Gao et al., 2017).

Smartphones and new information technology have great potential to improve the diabetes self-management system. It is exciting to see effective of diabetes self-management mobile app to decrease the HbA1c for patients in Kirwan and coworkers' research (2013). However, to develop a better diabetes self-management mobile app also needs medical professionals, researchers and app developers to work together and concern the age of the user group (Gao et al., 2017).

2.2. Major Challenges

Although mobile Health (m-Health) providing so many benefits for both patients and health professionals, it is still a new field of healthcare. Lots of problems and issues remain unsolved or not clear. The major problems are raised such as, how good the quality of the service is going to be, how reliable and efficient the service can provide to patients and how complete the claimed functionality is going to perform for patients (Silva et al., 2015). Besides that, since m-Health processes sensitive privacy information from patients, the security of information privacy is discussed over and over again (Silva et al., 2015). Luckily, users have been protected by the Department of Health & Human Services of the U.S. Food and Drug Administration (FDA) who has published and enforced the regulations of medical devices (FDA 2013).

Further study and research on the influence of m-Health still need to be performed. Topics such as, how much costs are reduced by using m-Health, how exactly the m-Health impact on patients and health professionals and how the security of sensitive information can be enhanced. For better development of m-Health, all those problems need to be further studied and summarized.

CHAPTER 3. SYSTEM OVERVIEW

3.1. General Overview

The Health Mobile Application for Diabetes self-management consists of the frontend client, provider side and the backend server-side.

The client-side is used by patients. Patients can use this application to record their daily mood, stress level, blood pressure, etc. so that not only they but also medical providers can review those important data. Besides that, adding daily meal function in the patient side plays an important role in keeping patient daily nutrition intake healthy. Patients can easily find out which nutrition intake is exceeding the limit, just fine or lower than the limit. Accordingly changing the dietary is one of the fundamentals of Type 2 Diabetes management and therefore patients can optimize metabolic control (Breen, Ryan, Gibney, & O'Shea, 2015). There are other functions like chatting with patients and providers, directly calling and email providers, reading education articles from providers and so on. Those functionalities are extremely helpful for patients to gather together, share their thought, immediately contact providers and get educated. The main purpose of the patient side is to provide a platform that can let patients manage their behavior by themselves, communicate with each other and provide a convenient way for providers to supervise them. The patient side as a self-management healthcare system is aiming at encouraging and guiding patients to know themselves better, trade themselves better and therefore let them build a better quality of life. Mobile health applications are most likely to improve the current situation of chronic diseases like diabetes or asthma which has long-term conditions and requires continuously providers' attention and self-management from patients (Simpson et al., 2017). The provider side is used for collaborating with the patient side. When

both sides work together, it can make a great impact not only for patients but also to provide a helpful tool for medical providers.

The provider side is used by medical providers to supervise and remind patients whenever it is necessary. Providers can communicate with their patients by either messaging, emails or make a phone call. The app also provides an enhanced searching functionality that allows providers to not only searching patients by their name, age, gender but also look them up by their health information such as diabetes type, glucose range, and daily carb intake. Those are especially helpful for providers who are looking for patients who aren't managing themselves very well and remind them to get back to the right track as soon as possible. Besides that, the application enables providers to post healthcare tips or articles to better enrich patients' knowledge. Another important feature that the provider side possesses is that the providers can look up patients' health information graphs such as carbs intake, blood sugar, blood pressure, general mood, and stress level. The timeline could be extended from daily up to 3 months. It visualizes the trend of patients' health information and allows providers to make better and easier treatment decisions. Overall, the main goal of the provider side is to provide a convenient way for providers to supervise, educate and communicate with their patients from different perspectives. The functionalities from the provider side provide several powerful tools for medical providers. Therefore, patients can receive great services and treatment effectively.

Both the provider side and the patient side are developed for smartphones and users need to connect to the internet for either upload or receive data. When users process the services like adding a meal, uploading their blood pressure, posting education tips, etc., the data are transmitted to the backend server and the data is sent back to frontend after the server finishes off the request. The image below shows how is the user using the app and acquire services.

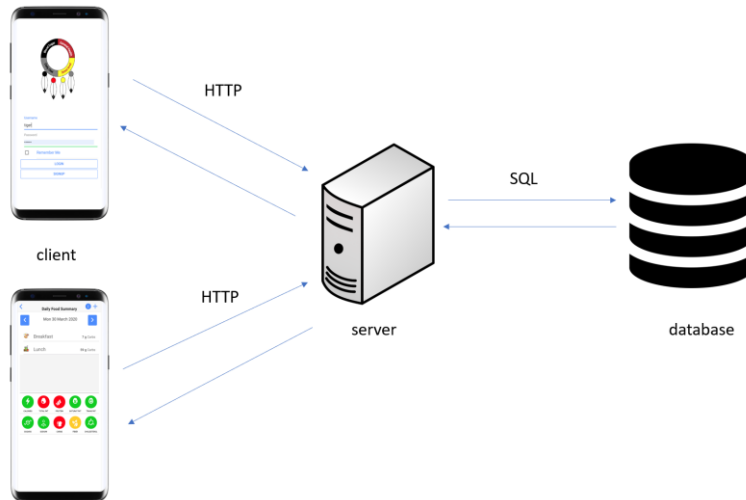


Figure 1. Client-Server Model

By using the Hypertext Transfer Protocol (HTTP), the clients and servers are enabled to transmit data back and forth. Then the server will process the HTTP requests and query the database by using SQL (Structured Query Language). Some of the common methods that our applications used are GET, POST, PUT and DELETE. The GET function is used for retrieving the data from a specified resource. For example, in the second phone screen capture of Figure 1, when building this page, the client is calling the GET method to retrieve the meal information of that day. The server receiving the GET service and process it inside the server and finally using SQL to pull out the data from the Meal table in our database and display it on the client-side. Both POST and PUT methods are used for creating and update the data. For instance, when users update or create their daily meal, blood pressure, blood sugar, etc. The POST or PUT method is calling from the client-side and handled by the server. The only difference between the POST and PUT method is when creating data POST will create the same data multiple times whereas PUT will only create the same data only once. The DELETE is easier to understand which is simply delete the specified data from the database.

By using those common methods of HTTP, the applications are available to finish most of the functionalities. The backend server as the core of the client and server model, it accounts for all the requests either from the patient or provider application. The server needs to be running all the time and waiting for the requests and send back data to the client-side.

The majority of work that I contributed is from the client-side. Most of them are design and developing for the user interface. The user interfaces like chatting histories main page in Figure 8, chatting conversations in Figure 4, the social information page in Figure 16, and almost all the pages in the Educational component. I have also worked on some parts of the backend server-side. Most of them related to testing purposes. Besides that, I have involved in the full testing for all of the functionalities and pages for both patient and provider side and fixed all the bugs that was found.

3.2. Important Components

The food recommendation component is one of the most important features in our application. Based on (Breen et al., 2015), Dietary choices based on nutrition knowledge can optimize type 2 diabetes (T2DM) patients' metabolic self-management and quality of their life. However, most of the patients do not have the intention to acquire or have the food nutrition knowledge which can help them optimize their health. The Food recommendation component in the application can solve this problem. First of all, Patients can add their daily meal to the Food component dashboard like it showed in Figure 2. Then the app will automatically calculate the nutrition value for patients based on their daily recipes and give useful advices to their daily meal. As a part of self-management system, it is promising that this feature can tremendously help patients self-manage their food choices every day and improve both their quality of life and metabolic.

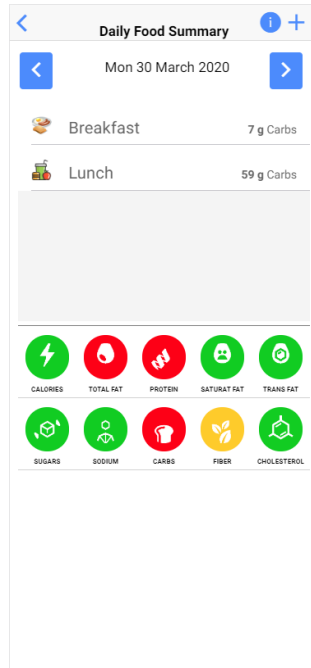


Figure 2. Daily Food Summary Page

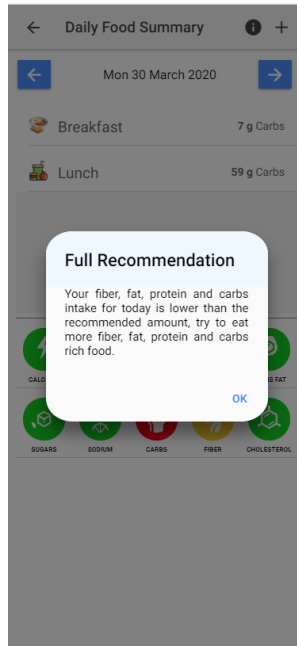


Figure 3. Food Recommendations

Chatting component builds a communication bridge between patients and providers. It enables users from both sides to communicate with each other without any obstacle. The main

purpose of the chatting component is to create a user-friendly way for patients and providers to communicate with each other. This component makes both providers and patients so much easier to communicate with each other without using a third-party method like messages or phone calls. Once there is something that they need to talk using this app, they can instantly use this function and messaging each other in real-time.

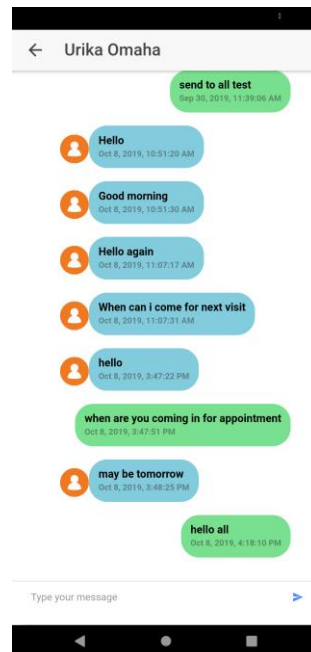


Figure 4. Chatting Conversation

The education component is playing an important role in helping community members to acquire healthcare knowledge from providers. Instead of acquiring health knowledge by users themselves, the Education component can easily help medical providers to efficiently educate patients in their community. On the other hand, patients can acquire health knowledge in a trendy way rather than met with provider in person. We are looking forward to seeing how efficient this component can assist providers to educate users with useful healthcare knowledge.

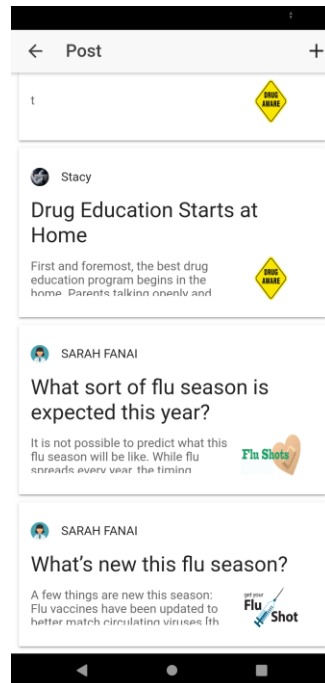


Figure 5. Post Page

As an important part of daily self-management, showing patient's daily health information like feelings, pressures, blood sugar and blood pressure are important. It will not only let patients notice their health condition but also remind providers if those health conditions go off the track.

In our application, the daily health information is kept tracking every day. All the health information like general health, blood sugar, daily diet, and stress level is displayed as a graph on the main page like figure 6. Patients can see their basic health information trend every day by viewing the graph generated by the application. They can make adjustments to their food or daily activity by themselves through their understanding of the graph. Meanwhile, the graph and information are also visible by providers so that they can remind patients about their general health when it is needed.

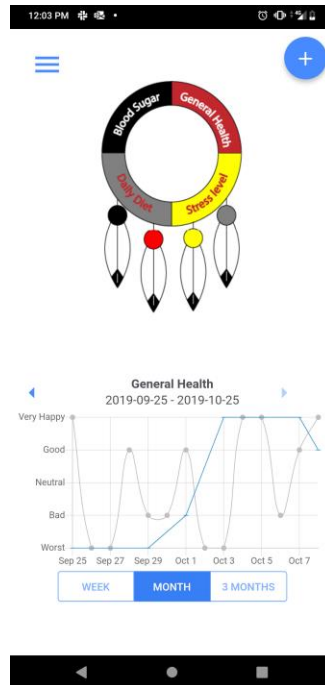


Figure 6. Daily General Health

Notifications function is also a very important function that can remind providers or patients that if the patient is self-management very-well. Once the patients' blood sugar is lower than 60 mg/dl or greater than 140 mg/dl, the notification will be sent to the provider in real-time. Similarly, if the systolic is lower than 90 mmHg or greater than 160 mmHg and diastolic is lower than 60 or greater than 100, it will send notifications to the provider and need emergency contact.

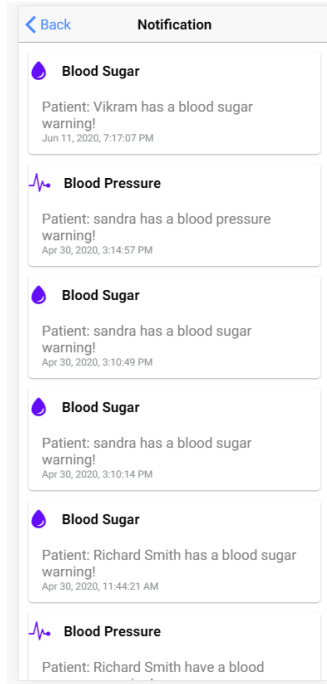


Figure 7. Notifications

CHAPTER 4. CHATTING AND COMMUNICATION

FUNCTIONS

4.1. Functional Requirements

Table 1. Functional Requirements of Communication Functions

Function Name	Function Description
Chatting Histories	Users are able to view their chatting conversations.
Messaging	Users are able to receive and send messages with their friends in real time.
Group Messaging	Users are able to receive and send messages with specific users in a group in real-time.
Creating Group Conversation	Users are able to create a group conversation based on the friends they choose.
Friends List	The application can list all of the user's friends
Searching Friends	Users are able to search their friends by email, username or social name.
Managing Friend Requests	Users are able to check the friend's requests status either sent to others or received from other people.
Social Profile	The application can provide social information for users to view.
Social Information Availabilities	Users are able to change the availabilities of their social information such as everyone, only to me or for friends.
Saving Changes	Application allows users to save changes of their social information.

4.2. Chatting Component Flow Chart

To better demonstrate how all the functions working together, the flow chart is provided in Figure 8. On the main page, users are going to view their chatting histories. They can decide if they want to start a chat or use other functions. If users want to search for new friends, the searching function will help them. When users want to add new friends, the friend invitation request is sent out. Besides that, users can also view their social profile page and make changes or decide to create a group for group chat.

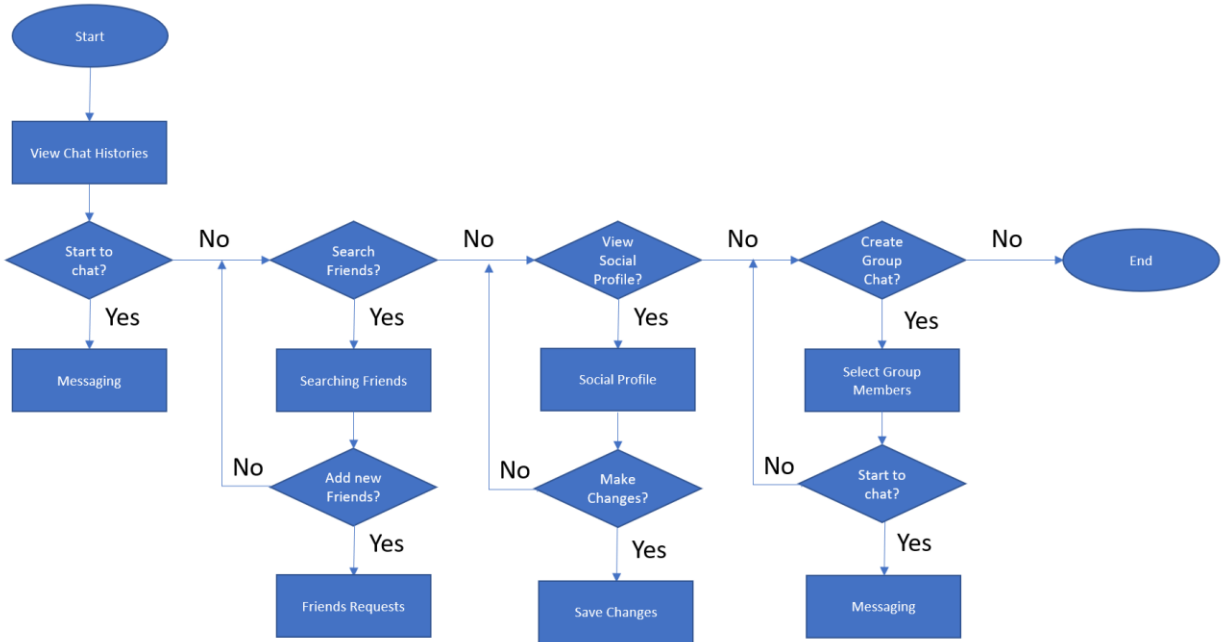


Figure 8. Chatting Component Flow Chart

4.3. Chatting Component Functions

The contribution that I made are most user interface design, development, and testing. Such as the user interface for chatting histories in Figure 9, chatting conversations in Figures 4 and 10, and social information page in Figure 16. Moreover, the full testing for this component and reporting and fixing everything that I found and finally make sure every function work as expected.

4.3.1. Chatting Histories

Allow users to view their chatting conversations is one of the most important functions in the Chatting component. The chatting histories user interface borrowed the idea from the most common and popular chatting applications. In Figure 9, the chatting histories are listed from the most recent to least recent. It makes easier for users to check their most up to date messages. Users can click either one of their message conversations to get into the chatting user interface

and start to chat. The name and avatar of friends are displayed on the left hand of each chatting conversations. Users can easily identify the chatting conversation they had with this person.

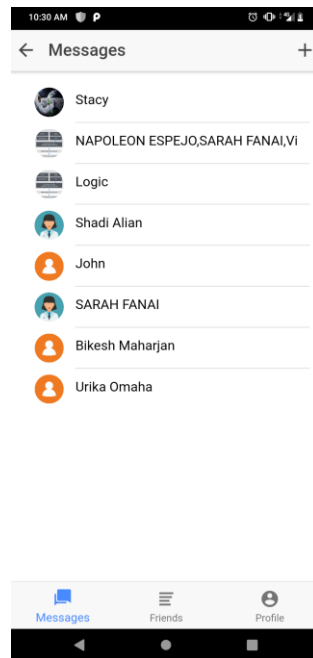


Figure 9. Chatting Histories

4.3.2. Messaging

The main purpose of the chatting and communication component is to allow patients and providers to message each other in real-time. Once users click one of their message conversations, they will be navigated to the messaging user interface.

As you can see in Figure 4, messages come from the user appear on the right-hand side of the window and the messages replied by the other user is on the left-hand side of the window. Users can send a new message by typing in the message window on the bottom of the screen and tap the paper plane to send. After that, the new message will show up in both users' chatting user interface. Both send messages and received messages are displayed in real-time in this user interface. Therefore, it enables users to conveniently communicate with each other.

4.3.3. Group Messaging

In addition to the one to one messaging, the application also implements the group messaging which allowing multiple people chatting in the same conversation. It is very important for either patients or providers who have the same topics or tasks need to talk about. For instance, providers may want to create a group chat with patients who all have high blood pressure. During chatting in the group, providers can give patients some useful tips. Patients can also share their progress to reduce their blood pressure. The messaging user interface is as same as the one to one conversation. The only difference is it allows multiple people can talk to each other in the same chatting room in real-time.



Figure 10. Group Chat Conversation

4.3.4. Creating Group Conversation

To start a group chat, users have to create a group first. To create the group chat, users can tap the little plus icon on the top of the right corner in figure 9. It will navigate the user from

the main page to the grouping page. Figure 11 shows what is the grouping page looks like. Users can choose the type of users they want to add by tap the tab on top of this page. They can also use the search bar to search for a specific person they want to add in their group. Pick multiple users by tapping the circle at the right side of the user and finally click “OK” to confirm. Then the group chat will be created.

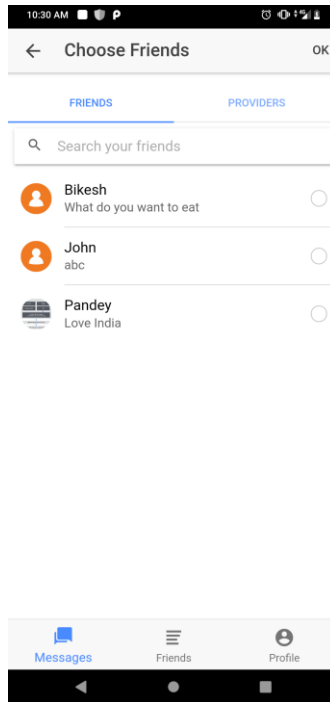


Figure 11. Creating Group

4.3.5. Friends List

Besides communicating with people, knowing who to contact is also very important. The chatting component provides a user interface that allows users to view their friends' list.

Figure 12 shows the user's friends list. For each of the friends, it shows the friend's name, avatar, status, the online-offline indicator, and the messaging button. The name and avatar can quickly make users to identify their friend. By clicking the messaging button, it will prompt the user to their messaging window so that they can immediately chatting with each other.

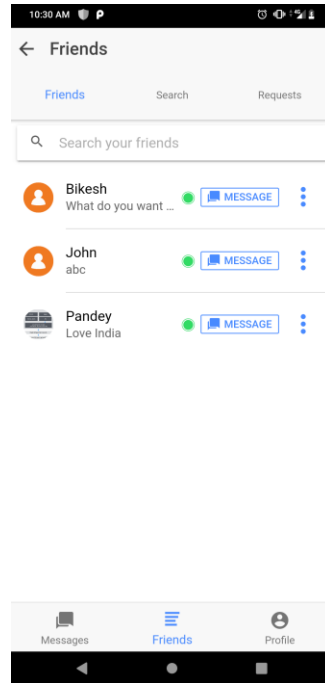


Figure 12. Friends List

4.3.6. Searching Friends

The search bar in Figure 12 can help users to search their added friends by giving the friend's name. if the user has lots of friends it is very helpful for them to find the friend they look for. Besides that, the application also provides an advanced search for searching all of the users in our database. The search tab in the Friends page figure 12 will navigate users to the advanced friends' search page. In Figure 13, the advanced search function allowing users to search for new friends by their username, name, or emails. By tapping the gear icon at the end of the search bar, the users can switch the category they want to use for searching. It can save lots of time for users to search for friends in their community if they have any information for those users.

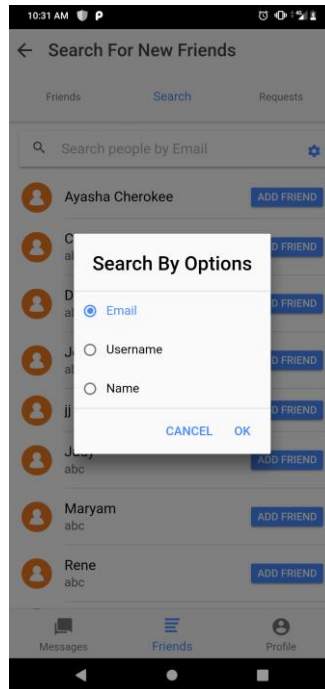


Figure 13. Advanced Search Friends

4.3.7. Managing Friend Requests

When users try to add new friends or received the friends' invitation, requests will display on the request page for managing. Figure 14 the request page shows the users' friend requests status and allows users to decide how they want to deal with those requests.

The invitation friend request is triggered when users click adds friends in the searching fiends page, then the requests will appear in both users` Requests page. If the other user approved the friends' invitation request, the request will disappear for both users. The invitation request can also be rejected or recall by tapping the cancel button.

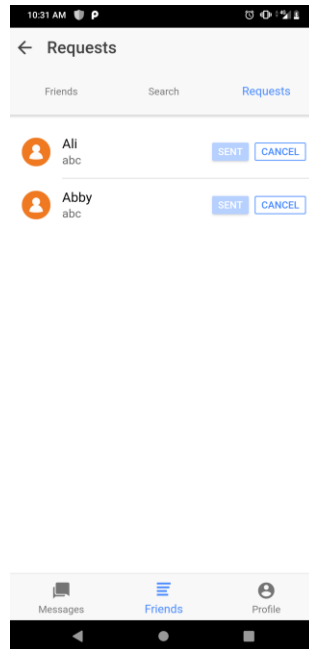


Figure 14. Friends Requests

4.3.8. Social Profile

The social profile is used for listing social information of the user such as the name, status, e-mail, age, and interests. People who are looking for this person can have basic information about this person. It can make people from the community get along with each other easily.

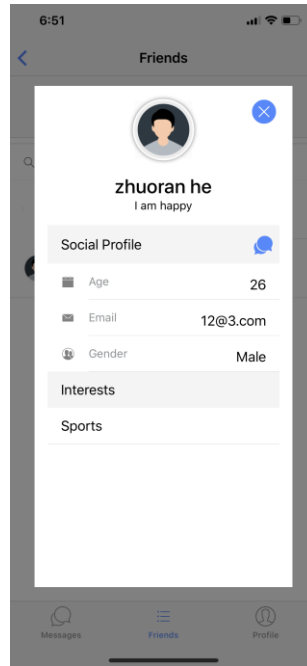


Figure 15. Friends Social Profile

4.3.9. Social Information Availabilities

Some of the social information may be sensitive to users. To protect users' privacy, the users have their own choice to set each one of those information availabilities to public, friends, or private. In Figure 16, there are three availabilities "Only Me", "Friends" and "Everyone". Only me is the most private setting. After setting availability to this, that information is only available for user their self. The "Friends" availability only allowing their friends to see, and "Everyone" means the information is available for everyone who is searching for this person.

Protect patients' private information is always the first priority for a healthcare application. It is also a hotly discussed topic and concerned by lots of people. By implementing this feature, the application can rule out the confusion about this problem.

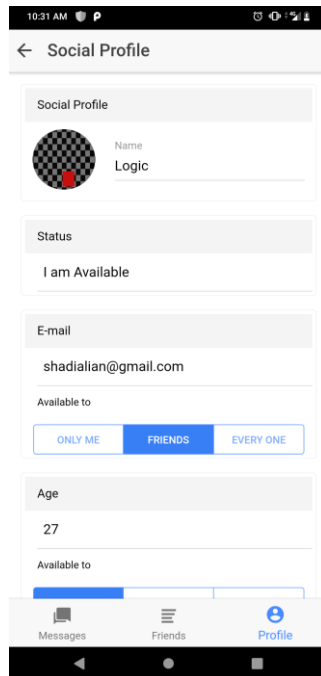


Figure 16. Profile

4.3.10. Saving Changes

Registered information like age, email, and gender are not allowed to change. However, there is always the case that users want to change their social information like social name, status (what is going on recently), and interests. Once users want to change their information or the availability for that information, they can feel free to change and tap the “SAVE CHANGES” button on the bottom of the social profile page to save.

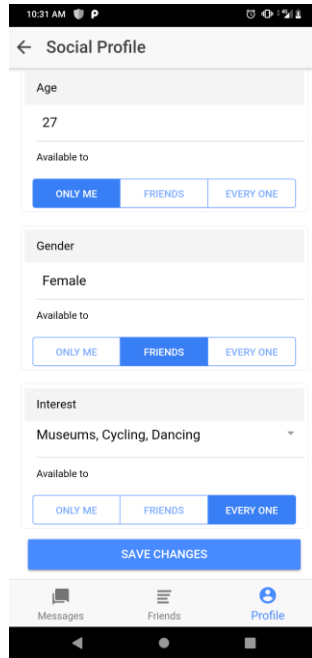


Figure 17. Profile 2

CHAPTER 5. EDUCATION FUNCTIONS

Education functions are aiming at allowing providers to spread health knowledge to their patients. In our application, it implements two main functions: Post function and Tips Function.

Post function will allow providers to post a long-paragraph article and attach a picture. While healthcare tips function is developed for providers to educate their patients about some basic and concise healthcare knowledge. It borrowed the idea of social media of how it is spreading the information which is a new trend for people to share, explore, and experience their life. However, in our application, we focused more on its educational purpose.

5.1. Functional Requirements

Table 2. Functional Requirements of Education Functions

Function Name	Function Description
View Posts	The application allows users to view posts from their providers.
Creating Post	Providers are able to create their posts.
Upload Picture for Post	Providers are able to attach a picture for their posts.
Delete Users' Own Post	Providers are able to delete their posts.
Edit Users' Own Post	Providers are able to edit their posts.
View Tips	The application allows users to view tips from their providers.
Creating Tips	Providers are able to create their tips.
Delete Users' Own Tips	Providers are able to delete their tips.
Edit Users' Own Tips	Providers are able to edit their tips.

5.2. Education Component Flow Chart

The flow chart can make it clear how eternal functions working together. Although the patient side and provider side share the same functionalities as view posts and tips, the provider side has other functions like creating posts and tips, delete and edit their own posts and tips, and posts pictures. Therefore, there are two separate flow charts to demonstrate the education component.

5.2.1. Patient

As the patients can only view the posts and tips from their providers, the flow chart is fairly easy to understand. After entering the Education component, posts will be displayed for patients on the main page and they can decide do they want to keep reading tips.

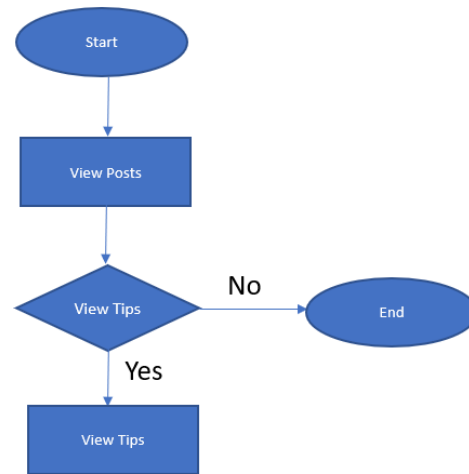


Figure 18. Education Component Patient Flow Chart

5.2.2. Provider

On the provider side, users will view existing posts when entering the Post page. Then they will have more functionalities like create a new post with a picture, edit or delete a post.

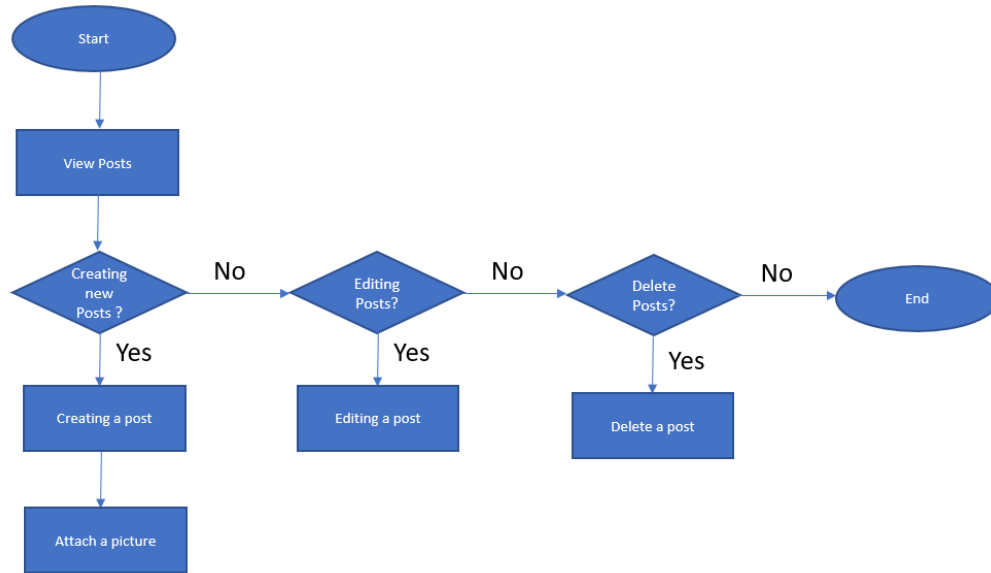


Figure 19. Provider Posts Flow Chart

The Tips page almost works the same way as Posts page. The only difference is the Tips component will not include the attaching picture function.

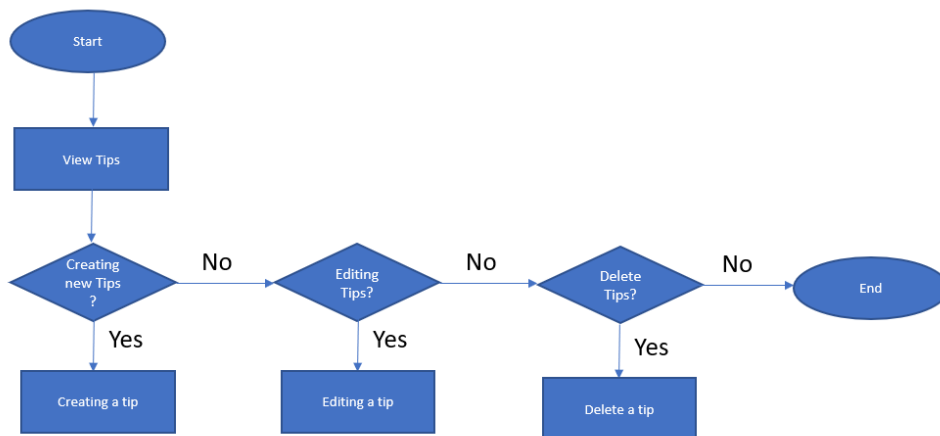


Figure 20. Provider Tips Flow Chart

5.3. Education Component Functions

In this component, I have participants in all of the design, development, and testing. Frequently, testing and development for both patient and provider application to make sure every function work as expected. Such as searching for the popular UI design online and viewing other

popular social media apps for ideas, make sure users view the most recent posts from top to bottom, assign the authority for authors to delete or edit their posts, tested the real phone photo library and camera functions for posting pictures and so on.

5.3.1. View Posts

Posts function is used for providers to post long-paragraphed healthcare articles for their patients. Figure 5 shows the Post user interface. The most recent posted thread is shown on the top along with its author, title, posted date, and related information. On the Post page, the top left corner showed the author's avatar and name. After that is the title and the detail information of this post. The picture attached to it is shown on the right-hand side of the post. Users can click each post to view the detailed of the post which display the full content and bigger picture of this post.

5.3.2. Creating Post

Only providers can create their posts by tapping the plus icon at the top of the right corner in Figure 5. The user interface for creating a post is shown in Figure 21. The first line is the title of the post and the text area is for the context of the post. User can attach one of the pictures from their smartphone to their post by tapping the picture icon next to the title line and make the post more vivid. Finally, after the user finish all of the editings, by tapping POST to publish or CLOSE to cancel this post.



Figure 21. Creating Post

5.3.3. Editing and Deleting Posts

It is always the case that people want to make modify or even entirely delete their posts. Only the author of the post can make changes or delete their post. Like the screenshot showing in Figure 22, providers can tap the options icon on the right top of the corner of this detail page and choose either delete or edit for this post.

Providers can edit the text or switch a picture for their posts as it showed in Figure 23. Once all the editing is finished, providers can tap DONE to finish or go back to the last page to cancel the editing.

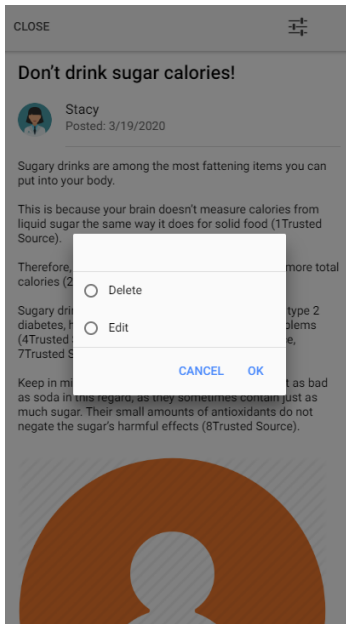


Figure 22. Edit Posting

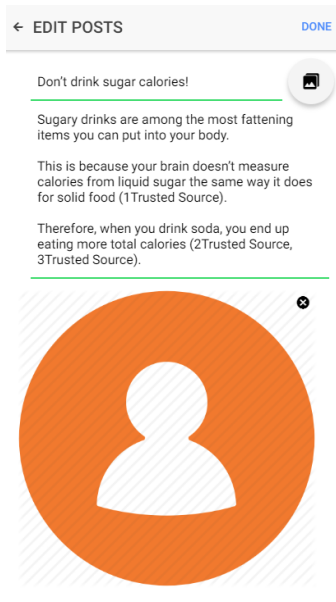


Figure 23. Post Detail

5.3.4. View Tips

Tips function is very similar to Post function. However, the information is more concise and shorter than the posts. The healthcare tips like how to correctly wash your hands or coughing

and sneezing manner can be very helpful for patients. Those tips can educate patients very well and enrich their health knowledge from a scientific way.

The Tips user interface is shown in Figure 24 which is similar to the Post interface, the title is shown on the top of the tip, and under it are the author's name, avatar and the post date of the tip.

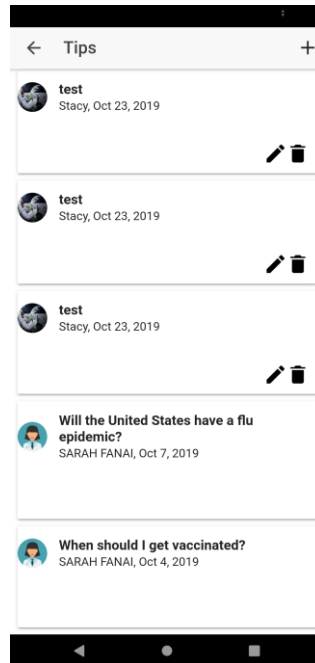


Figure 24. Tips Page

5.3.5. Creating Tips

Again, only providers can create their tips for sharing concise healthcare knowledge. The plus icon in Figure 24 will navigate providers to their tips editing page in Figure 25. The first line is the title of the tips. The rest of the text area is the content of these tips. Providers can also give the related tips link in the content. It will automatically trigger users' web browsers if they are interested in the source. After the user finishes all of the editings, tap POST to publish and the new tip will be displayed on the tips main page.

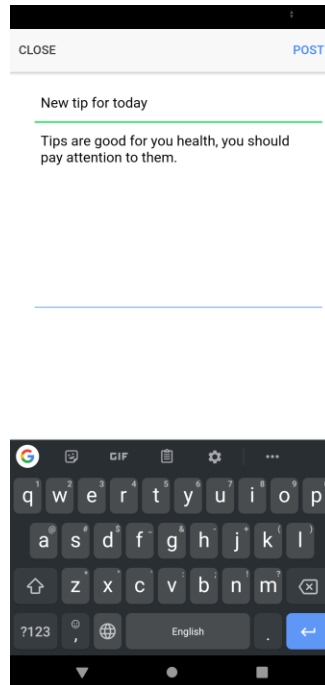


Figure 25. Creating Tips

5.3.6. Editing and Deleting Tips

Only the author acquires the authority to edit or delete their own tips. Like it showed in figure 24, providers can tap the pencil icon to edit or delete it by tapping the trash can icon. Only the authors can do these two operations. If the tips are not belonging to the author, both the pencil and trash can icon will not be displayed.

The Editing user interface looks the same as creating tips. The title “EDIT TIPS” and “SAVE” button will notify users that they are editing their existing tips. Besides that, the delete functions will be immediately triggered when the trash can icon is pressed. The Tips main page will refresh automatically display the new ordered tips.

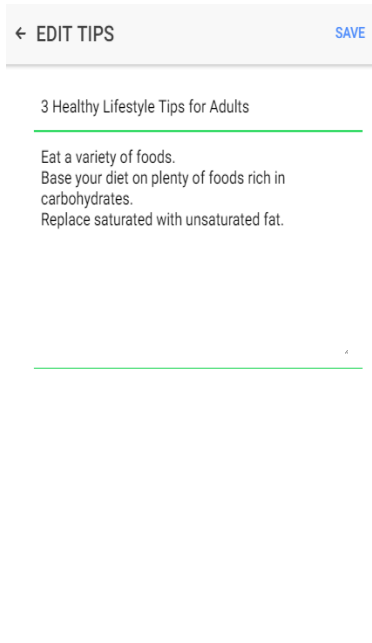


Figure 26. Tips Editing

CHAPTER 6. CONCLUSION

Our application takes the advantages of mobile health and self-management system which provide remote monitoring, reviewing, self-managements, and contacting functions regardless of time, physical and financial constraints. It is extremely helpful for chronic diseases like diabetes. Components like food and daily general health allow patients to add and review their daily meals, blood pressure, blood sugar, and so on. As it overcomes the financial, time, and physical constraints, it provides a convenient way for patients to self-manage themselves and visualize the progress towards their goal. It addresses the characteristics of self-management systems which lets the patient realize the importance of their decision making. Education and Chatting components prominently addressed the benefits of mobile health advantages which overcome the time and physical barriers. The application is ready to move on to the real user testing phase and it is inspiring to receive any feedback and suggestions to make this application better.

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